KAUA'I INVASIVE SPECIES COMMITTEE

U.S. Fish and Wildlife Service

Island-Wide Invertebrate Survey

Early Detection and Rapid Response to Invasive Invertebrates on the Island of Kaua`i

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Early detection is a strategy that enables conservationists to identify threats before they become widespread and out of control. Invasive species are non-native species that rapidly out-compete native plants and animals. By employing early detection methods such as island-wide surveys, KISC has taken an aggressive step towards preventing new and destructive invasive species from establishing on Kaua'i.

Project Description

The purpose of this current project is multi-fold: conduct expanded island-wide surveys based on an existing nursery survey list currently being used, conduct outreach that ties into an Early Detection Network Program developed for Kauaʻi, and conduct rapid response, when necessary, in collaboration with the Hawaii Department of Agriculture (HDOA) and other partners.

Systematic surveys included visual inspections, placement and collection of baited vials, and dialogue with importers as well as the general public. Vials with ants were sent to HDOA for identification.

Background

In 2006 KISC completed an island-wide survey for the presence of Little Fire Ant (*Wasmannia auropunctata*) on Kauaʻi (http://www.hear.org/kisc/pdfs/200701kauaiwasmanniareport.pdf). This survey took a comprehensive look at high risk areas, nurseries, greenwaste and transfer stations, and various other locations throughout the island. The purpose of this survey was to determine if there were any new introductions of LFA outside of the one known infestation in Kalihiwai (introduced in 1999). Results of this survey were encouraging in that no other populations were detected.

Since that survey, KISC has incorporated invertebrate survey work into their daily routine. Crews have been repeatedly surveying nurseries and greenwaste areas for not only LFA, but myoporum thrips (*Klambothrips myopori*), and nettle caterpillar (*Darna pallivitta*). Protocol that was developed by Cas Vanderwoude, Hawaiʻi's state-wide Ant Coordinator, has been used to systematically survey, collect, and identify LFA in collaboration with the Hawaiʻi Department of Agriculture (HDOA). Training by HDOA personnel has enabled the KISC crewmembers to identify signs of infestations of the thrips and caterpillar so that they, if detected, can be reported to HDOA and rapidly responded to.

Little Fire Ant (LFA) (*Wasmannia auropunctata*)

The Little Fire Ant is listed as one of 100 of the world's worst invasive alien species[1], affecting (impacting) our quality of life, agriculture, and environment. Originally from South America, LFA have spread through tropical regions worldwide in the last 100 years and are also called Electric Ant (New Caledonia), Cocoa Tree Ant (Solomon Islands), and Liklik Paia Anis (Papua New Guinea).

LFA are only 1/16 inch long (the thickness of a penny), light to golden brown or orange in color, and move very slowly. They produce a fire-like burning sting followed by large welts and severe itching sometimes lasting for two or more weeks. The stings are known to hurt pets and livestock and multiple stings to the eyes can cause blindness in animals. Little fire ants nest under leaf debris, rotten limbs, stones, clumps of grass and up in the crotches of trees. Nests are frequently found behind the sheaths of palms or palmettos. This characteristic of nesting in trees makes this ant particularly hard to control. Little fire ants are also highly adaptable, nesting in both open and shaded areas, seeming to thrive equally well under moist or dry conditions.

[1] According to the Invasive Species Specialist Group's (ISSG) Global Invasive Species Database [www.issg.org]

A number of characteristics help LFA thrive in a wide range of conditions and environments, such as generalist feeding and nesting habits. LFA exhibit high colony mobility, readily moving to more favorable sites when they become available. They belong to a small group of ant species that scientists like to call "tramp" or "hitch-hiker" ants, that often travel from place to place by hitching a ride with freight items that are being moved from an infested location to a new location.

W. auropunctata were first reported to the Hawai‘i Department of Agriculture (HDOA) in Hawai‘i in 1999 having been discovered on the Big Island and believed to have arrived on plant material many years before. That same year, LFA were discovered in Kalihiwai, on Kaua‘i, believed to be transported on landscaping plants from an infested Big Island nursery. Initial response and treatment was conducted by the HDOA and the population in Kalihiwai was thought at that time to be eradicated after comprehensive surveys did not detect any LFA. In 2003, KISC partnered with HDOA to discover a resurgence of the Kalihiwai population and has been working in collaboration with HDOA ever since; conducting island-wide surveys as well as treatments at the infestation site (eradication efforts are ongoing as of this report). In October of 2009 LFA were also discovered on Maui on a single property in Waihe‘e. In January 2010 several outbreaks were found in Kona on the west coast of the Big Island. LFA are now widely distributed in East Hawai‘i with infestations occurring from Laupāhoehoe in the Hāmākua District, to Kalapana in the Puna District. The highest elevation in Hawai‘i which LFA has been found is 1,500’ at Mountain View. Infestations are also known in Waiākea Uka and Kaūmana in South Hilo. Over 50 infestation sites are known in East Hawai‘i. Of these, over a dozen nurseries and landscaper base yards are infested and are potential sources of infested potted plants. One study looked at shallow core samples taken from a tropical fruit orchard floor in East Hawai‘i and estimated that there were more than 95 million ants per acre, not including the ants living in the trees.

Ant specialist, Cas Vanderwoude, of HDOA and the Pacific Cooperative Studies Unit at the University of Hawai‘i Mānoa has been working on developing a special ant bait and application technique. Ants on the ground can be attacked with poison granules, but not little fire ants in trees. The first step, said Vanderwoude, was to develop a sticky carrier to spread on the trees. He mixed in a protein-flavored substance to attract the ants to his tree-bait and worked to make it suitable for Waihe‘e’s wet climate at the infested site on Maui. Until this new bait was developed, there were only ground treatments for little fire ants. The new bait provided treatment in trees and vegetation where little fire ants nest. HDOA obtained a special permit from the U.S. EPA to use the experimental ant bait. The poison, Indoxacarb, is not registered for use against little fire ants on fruit trees, although the EPA has labeled it for other uses. Indoxacarb is designated by the EPA to be a "reduced-risk" pesticide and is considered an organophosphate replacement. It has moderate to low acute and chronic toxicity and does not cause mutagenic, carcinogenic, developmental, or reproductive effects, according to the EPA. Little fire ants are relatively easy to suppress in small areas but can be very difficult to eradicate completely, which requires consistent applications of bait. Hawai‘i is virtually the only place in the world where practical applied research is being conducted to develop new ways of controlling LFA. Vanderwoude has also launched the Hawai‘i Little Fire Ant website (http://www.littlefireants.com/) where visitors can explore and download information on the control, eradication, and biology of this invasive species.

Naio thrips (*Klambothrips myopori*)

Myoporum thrips is a recently established insect pest (on Hawai'i Island) which infest naio (*Myoporum sandwicense*), one of the most common trees in the native Hawaiian forest, next to 'ohia and koa. *K. myopori* likely originate from New Zealand or Australia where it is probably a specialist on members of *Myoporum*.

Adult naio thrips are dark brown to black, small (2-2.5 mm), elongated insects. Immature thrips are similarly shaped but appearing orange or yellow. Damage by the thrips includes severe gall-like distortion of the new leaves and terminals. Stunting of terminal growth occurs and leaf curling or folding is common. It is expected that many species of *Myoporum* will be susceptible, and in Hawai'i, naio thrips have been observed attacking both the prostrate (naio papa) and upright forms of the indigenous *Myoporum sandwicense*.

Naio thrips were first found attacking naio on Hawai'i Island in December, 2008. Although at this point in time, this pest has not been detected on other islands, given the frequency of inter-island transport of goods and people, and the precedence of pest range expansions, this species is likely to spread throughout the Hawaiian Islands.

Nettle caterpillar (*Darna pallivitta*)

Native to China, Taiwan, Thailand, Peninsular Malaysia, Java, and Borneo, the nettle caterpillar (*Darna pallivitta*) is a relatively new threat to Hawai'i. Adult moths are approximately half an inch long. Females lay up to 480 translucent eggs in small clusters on the underside of plant leaves. After hatching in about a week, larvae feed on plant leaves. They grow to about one inch in length have light-colored venomous spines and hairs. *Darna pallivitta* caterpillars have been found feeding on over 45 species of plants in 22 families. The caterpillar may cause painful stings and may cause allergic reactions in those who are sensitive to the venom. The entire life cycle of *D. pallivitta* lasts approximately 3 months, indicating the potential of having up to four generations per year.

Stinging nettle caterpillar was first discovered in Hawai'i in September, 2001, at a foliage nursery in Pana'ewa on the island of Hawai'i. Nursery workers there experienced an unusual burning and itching sensation on their skin after handling rhapis palms. Specimens sent to the Smithsonian Institution were identified as *Darna pallivitta*. The insect probably arrived from Taiwan.[2] Since its initial introduction, the nettle caterpillar has become well established in large sections of the Big Island and has been found on O'ahu, Maui, and now Kaua'i (detected during this survey timeframe by HDOA).

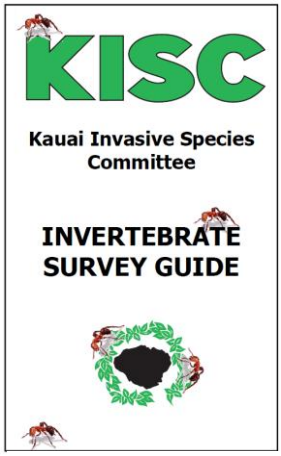
Because *D. pallivitta* flies well, once established in an area it is expected to slowly spread and form satellite colonies as it has on Hawai'i Island. *D. pallivitta* can also be readily spread on nursery and field grown ornamentals. It has already been intercepted numerous times by the California Department of Food and Agriculture. Because *D. pallivitta* is strongly attracted to night lights it may spread to other regions on commercial flights if airplane cargo holds are loaded at night.

[2] College of Tropical Agriculture and Human Resources brochure "Stinging Nettle Caterpillar, *Darna pallivitta*"

Survey

Surveys focused on nurseries and landscaped areas that import from the Big Island or elsewhere. Priority was given to green-waste areas, hotels, and private residences; high-risk areas where plant materials are being moved. Kaua'i's ports and the University of Hawai'i at Mānoa's College of Tropical Agriculture and Human Resources (CTAHR) Kaua'i Agricultural Research Center were also surveyed. 38 different sites around Kaua'i were extensively surveyed; from the Kekaha Landfill on the west side to Limahuli Gardens on the north[3].

After intensive training, the KISC invertebrate survey team, comprised of Pat Gmelin and Ray Kahaunaele, surveyed for three species of invasive invertebrates (little fire ant, nettle caterpillar, and naio thrips) at each of the above-mentioned locations. Visual surveys were made for the naio thrips and nettle caterpillar focusing on foliar damage, egg sacs, and actual insect sightings. No naio thrips were detected. During this survey period, nettle caterpillar was reported on the east side of Kaua'i to HDOA. The extent of this infestation is not known at this time as HDOA reports that they are conducting delimiting surveys.



KISC Invertebrate Training Guidebook

For LFA, labeled peanut butter- baited vials were placed every 10 to 15 feet around and in plants and trees. A GPS point was taken for each vial and the time was recorded. After 60-90 minutes, the vials were retrieved, capped (if containing ants), and recorded on a data sheet to match the GPS point. Any details about the site and vial placement were also noted. Vials with ants were frozen and mailed to HDOA for identification. A spreadsheet was made and sent along with vials (as well as e-mailed). Ant-filled vials were sent to HDOA on Oahu to Cheryl Young, and also to the statewide ant coordinator, Cas Vanderwoude, in Hilo on the Big Island for identification[4]. After identifications are received a report of the ant varieties found was sent to the property or business owner along with a KISC LFA-free certificate of inspection. This connection with the owners and operators of businesses and properties strengthens ongoing public outreach and education efforts.

From October 2010 until March 2011 a total of 4,338 vials were laid during surveys with 1,684 vials containing ants shipped to HDOA for identification[5,6]. 23 different ant species were found including a new record on Kaua'i of *Pheidole fervens*. No Little Fire Ants were detected outside of the Kalihiwai infestation. Approximately 77 acres were surveyed island-wide for *Wasmannia auropunctata*, 38 acres for *Klambothrips myopori*, and *Darna pallivitta* each.

[3] Kaua'i Nursery Survey Contact spreadsheet in addendum #1
[4] 2011 LFA Survey Record attached in addendum #2
[5] 2011 Site Ant Identifications spreadsheet in addendum #3
[6] Ants submitted for identification to Oahu HDOA were returned with full identification. Ants submitted for identification to Hilo HDOA were returned with only a "No LFA" status; specific identifications were not performed.

Education and Outreach

Educating the public and owners and operators of nurseries, landscaping businesses and green-waste areas is crucial for effective early detection and rapid response efforts. A good, direct dialog also helps to gain access to properties and areas for continued surveys. The Invertebrate team focused outreach on impacts to humans, agriculture, or biodiversity.

Oversized LFA replica use for display and education

KISC participated at many different public events to inform the people of Kaua‘i about invasive threats and the importance of early detection. Education efforts include teaching community members how easy home surveys are for invertebrate pests. Outreach materials included flyers, informational brochures, larger-than-life replicas, and actual specimens. Outreach events included the annual Arbor Day event, Garden Fair, Earth Day, Agricultural and Environmental Awareness Day, the Kauai County Fair, and school talks.

KISC Early Detection Field Guide

KISC has also developed an Early Detection Workshop that is part of the Pacific Basin Information Node’s (PBIN) Hawai‘i Early Detection Network. Each participant is given a Field Guide (available online at http://www.slideshare.net/nbiipbin/kauai-early-detection-field-guide) and shown ways to report pests through the HDOA Pest Hotline (808-643-PEST) and online at http://pbin.nbii.org/invasives_report/online.asp. Workshops were given to the Kapaa-Wailua Neighborhood Association, Rotary Club of Poipu, and to conservation partner agencies.

KISC’s island-wide invertebrate survey was also featured in the 2011 issue of *Kia‘i Moku*, an annual newsletter distributed online. (http://www.hear.org/kisc/newsletter/pdfs/kiaimoku2011v4n1.pdf)

Rapid Response

Responding rapidly to new reports of pests can quickly and effectively stop an infestation from occurring. The KISC Invertebrate Survey Team always prioritized these reports over their methodical surveys from the nursery survey list.

100% of reported invertebrate pests were for what were believed to be little fire ant. This may be due to the fact that most people are more aware of ants and the fact that some are reportable. KISC outreach regarding reportable ants (LFA and Red Imported Fire Ant) has been conducted for almost ten years. Upon survey and collection of ants, all were revealed to be tropical fire ant (long established on Kaua‘i) or other common biting ant species. No reports were confirmed to be little fire ant.

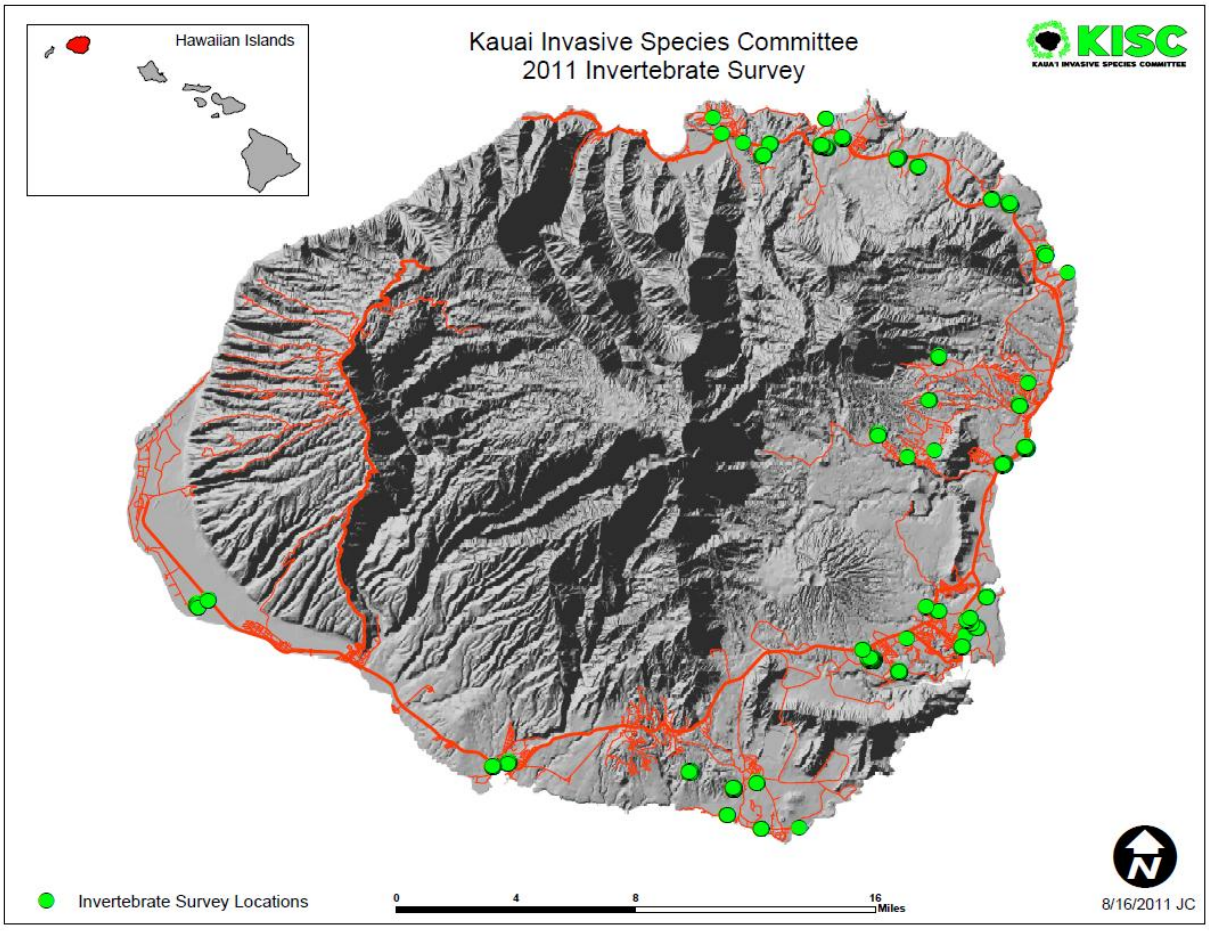
During this reporting period, nettle caterpillar was reported to HDOA having been found on gardening debris in Wailua. Although available to respond to this report and assist with delimiting surveys, HDOA chose not to utilize KISC personnel.

Data Management

Data management is done in partnership with the US Geological Pacific Basin Information Node. KISC fieldwork data is tracked in a Microsoft Access database. KISC spatial data is tracked using software from ESRI and hardware from Garmin.

Summary

Keeping Kaua'i free from selected invasive invertebrates will continue to become a challenge as infestations of these same pests reach overwhelming levels on neighboring islands. If we are to be successful in our campaign of detection, rapid response, and eradication we must focus on what is being protected: a "clean" horticultural export trade, a peaceful quality of life, and a unique ecosystem that can be found nowhere else in the world. With this recognition comes hope that it may be possible to marshal adequate resources to address the problem in a comprehensive fashion. Given rational management based on good science and with the help of informed citizens, this threat can and will be addressed.



[Addendums have been omitted from this online version to protect the privacy of landowners.]